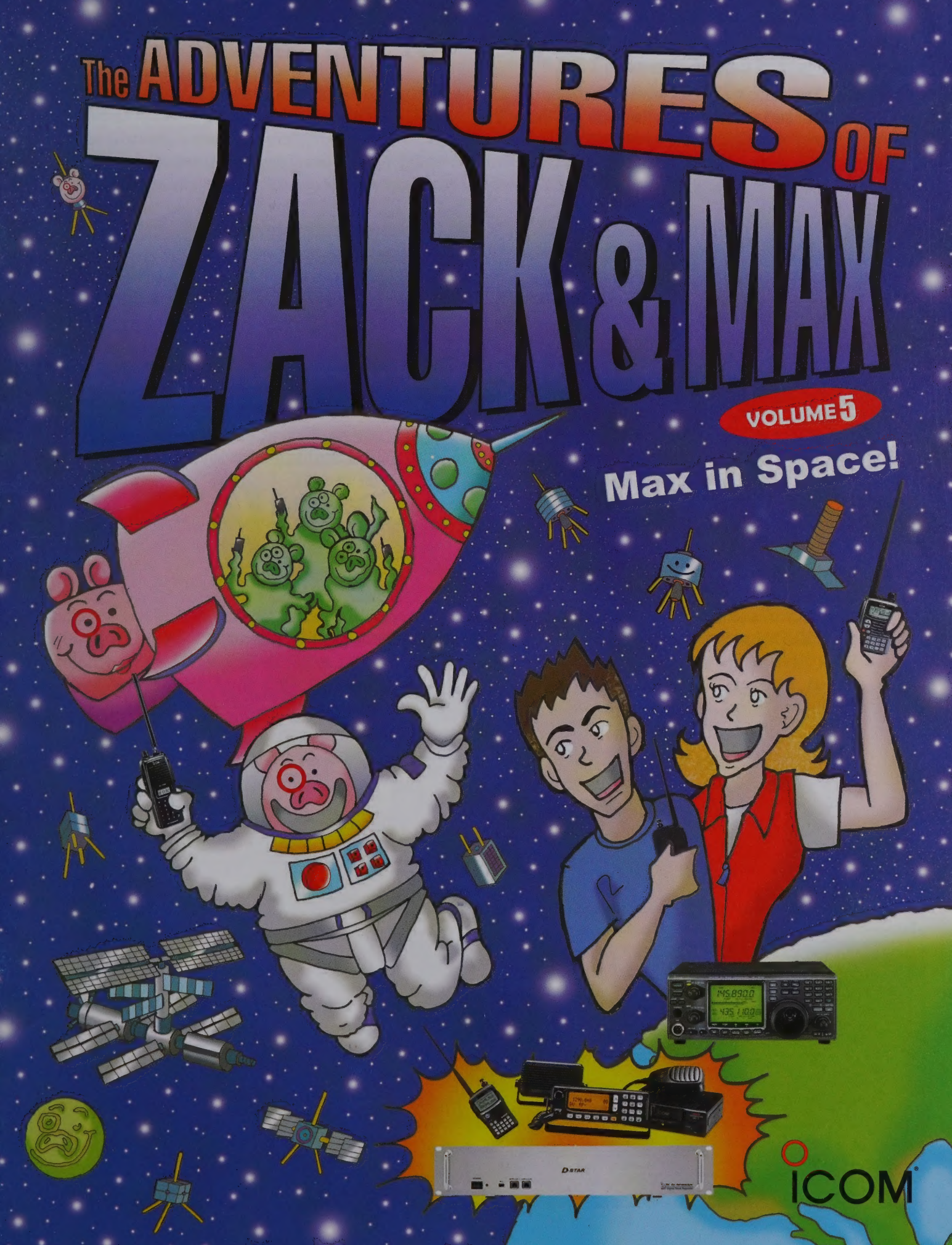
The ADVENTURES OF
ZACK & MAX
VOLUME 5
Max in Space!
D-STAR
ICOM

About The Story

Volume 5 of "The Adventures of Zack and Max" explores new radio technologies, both digital and satellite. The writers are again the students from the Lake Washington Ham Club (KC7OIO) at Ben Franklin Elementary School in Kirkland, Washington. Under the leadership of Mr. Dave Condon (KI7YP), the students set out to learn about amateur radio in space, specifically digital radio, satellites, and satellite orbits. Fortune came the club's way when Andy Hoskins (KE7HRJ), father of one of the students and a rocket engineer for Aerojet, suggested the club take a field trip to Aerojet's nearby facility where they build propulsion systems for satellites.

One Saturday, the students from the club with the help of Andy and his Aerojet colleague Brien McCrea (KE7WB), made links through an amateur satellite right from the parking lot of Ben Franklin! Icom America provided the equipment and technical knowledge to make the satellite links possible. Brien used his Icom dual band radio and a home brewed, hand-positioned beam antenna to track the satellite. The students were able to talk to people thousands of miles away—all the way from Alaska to California—with just their Technician privileges. At the same time using Brien's laptop, they also learned how to track when and where a satellite pass would occur.

This edition of the comic book was made possible by a team of writers that included Safa Mohammed (KE7HQX), Melanie Morris (KE7HRA), Mia Juric (KE7HQO), Claire Kruller (KE7AXJ) led by elected student editor Christa Hoskins (KE7HVF) who was assisted by writer Rachel Roberts (KE7HQQ). Many parents and members of the Lake Washington Ham Club supported the project through encouragement, transportation and assistance. And club leader Mr. Dave Condon (KI7YP) who has mentored hundreds of student hams to receive their licenses, provided guidance.

Special thanks to Andy Hoskins (KE7HRJ) for all of his hard work in coordinating field trips and story writing gatherings, and Aerojet for the tour of the facilities that served as inspiration to the writers, to Brien McCrae (KE7WB) for the execution of the satellite links for the club, and to M2 Antenna Systems for the contribution of 2 eggbeater satellite antennas to the club.

Kayoko Nakajima, professional cartoonist and illustrator, has created another splendid piece. Ray Novak (N9JA) and Maureen Blomgren (KD7QDZ) of Icom America not only produced and sponsored but also underwrote the publication.

Pictured from left to right; Mr. Condon and Christa Hoskins planing and editing the comic book with their friend Max. Christa with her dad, Andy Hoskins, and below our writers during their field trip to Aerojet.

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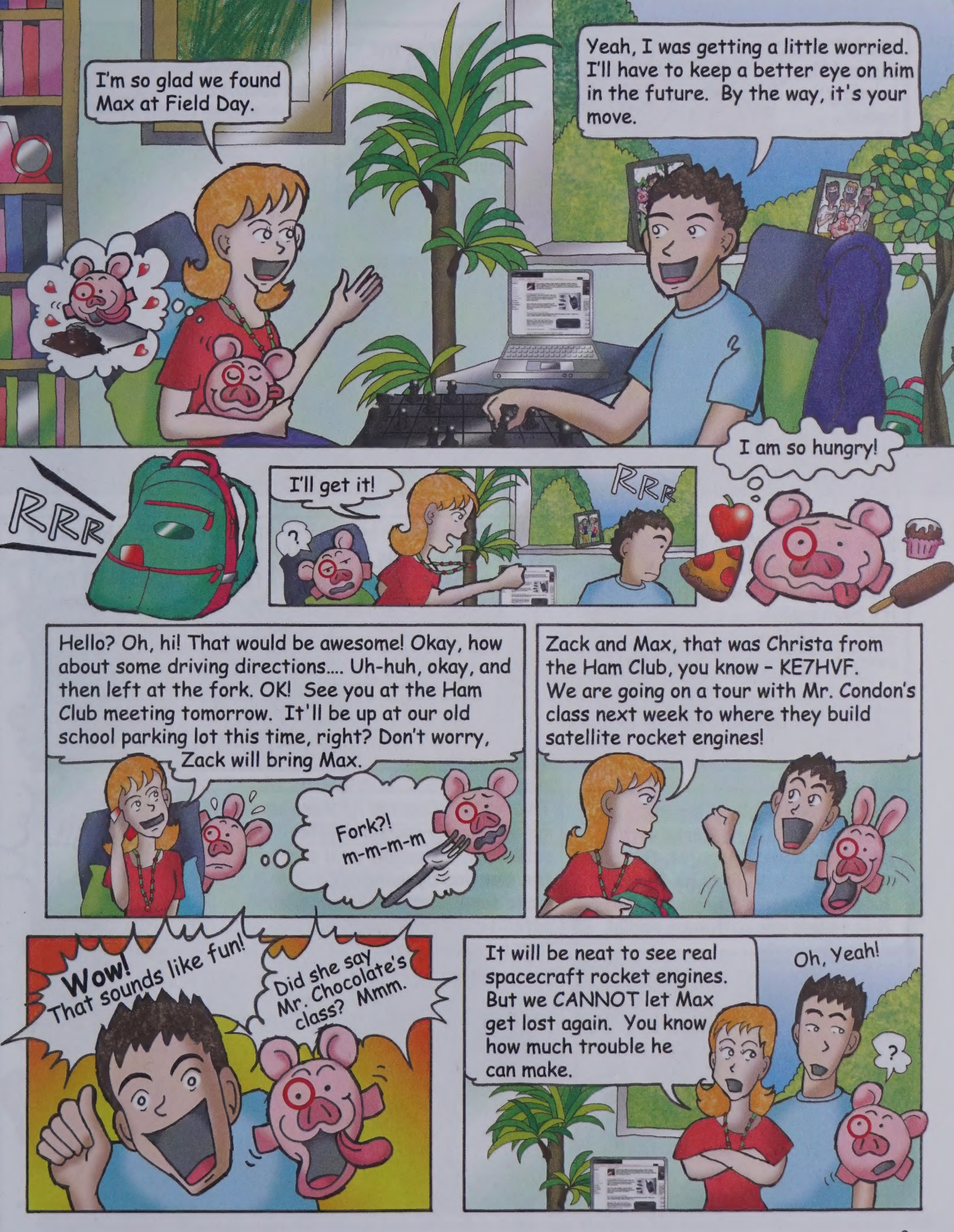
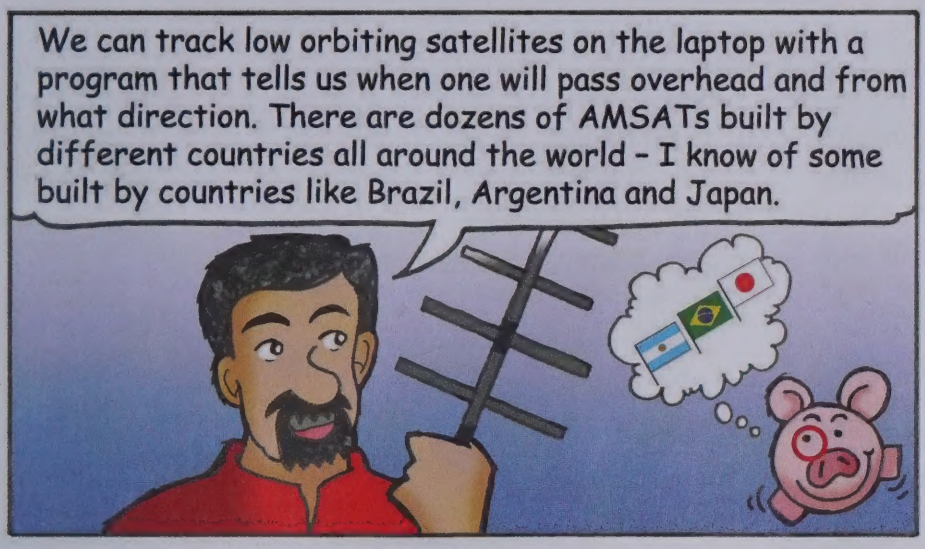
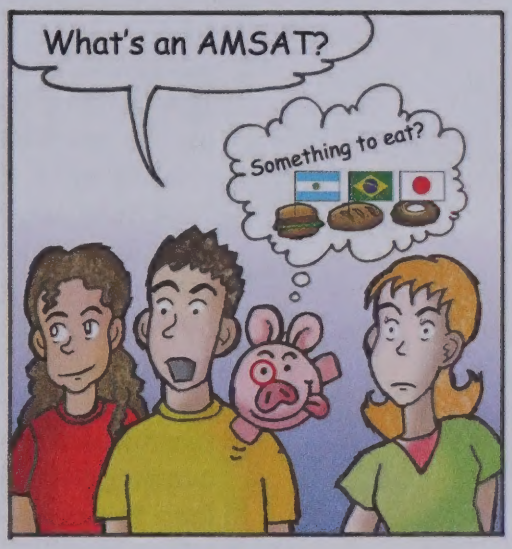
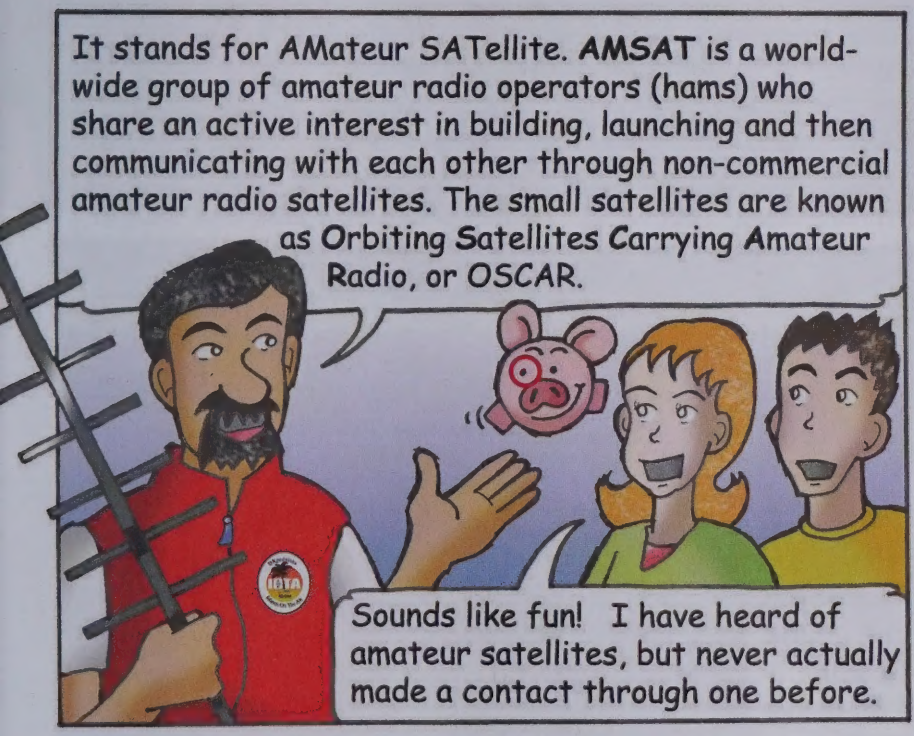
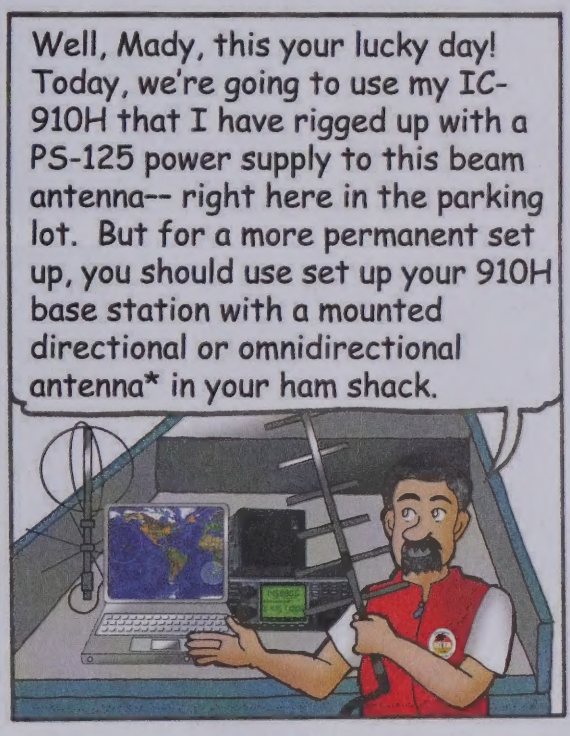

I'm so glad we found Max at Field Day.
Yeah, I was getting a little worried. I'll have to keep a better eye on him in the future. By the way, it's your move.
RRR
I'll get it!
?
RRR
I am so hungry!
Hello? Oh, hi! That would be awesome! Okay, how about some driving directions.... Uh-huh, okay, and then left at the fork. OK! See you at the Ham Club meeting tomorrow. It'll be up at our old school parking lot this time, right? Don't worry, Zack will bring Max.
Fork?! m-m-m-m
Zack and Max, that was Christa from the Ham Club, you know - KE7HVF. We are going on a tour with Mr. Condon's class next week to where they build satellite rocket engines!
Wow! That sounds like fun!
Did she say Mr. Chocolate's class? Mmm.
It will be neat to see real spacecraft rocket engines. But we CANNOT let Max get lost again. You know how much trouble he can make.
Oh, Yeah!
?

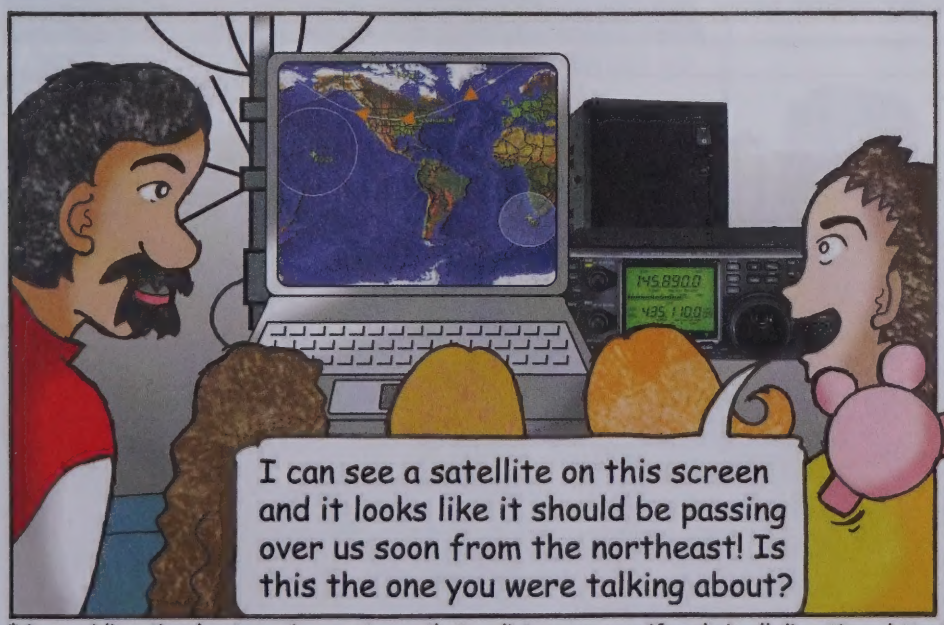
Well, I think I should be heading home... It's getting pretty late.
See you at the Ham Club meeting tomorrow! I wonder what the topic will be this month?
I'm not sure but it'll be good. See you tomorrow!
Bye!
At the Ham Club meeting in the school parking lot...
Hey, Mady and Zack! Now that you're in upper middle school, it's been a while since you've been over here!
Hi! Mady, remember me? I'm Claire, KE7AXJ, this is one of our new hams, Mia, KE7HQO!
Hi, I'm Mia. I've heard a lot about you and all the fun you had at Field Day!
Gang, today we have a guest, Brien KE7WB, who works with Christa's dad at Aerojet. Since he works with satellites he thought he'd demonstrate to you how easy it is to use one with your radio!
Thanks, Mr. Condon! At Aerojet we make space propulsion systems for satellites. I thought we'd start off the meeting by using our radios to make some contacts over an amateur satellite that's going to pass by in just a few minutes.
WHAAT!!! COOL!!!
How does THAT work?

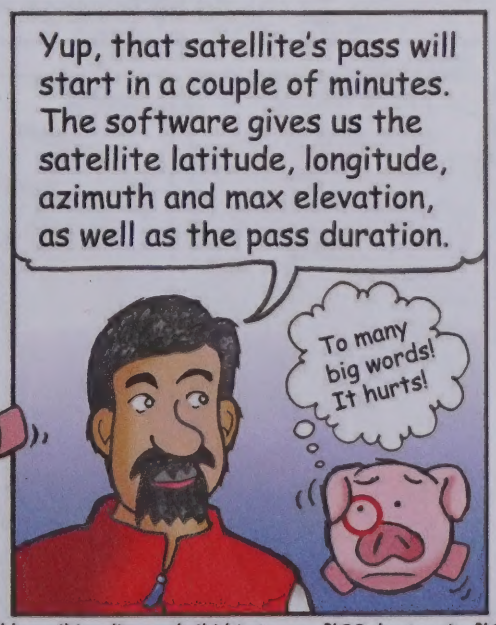

We can track low orbiting satellites on the laptop with a program that tells us when one will pass overhead and from what direction. There are dozens of AMSATs built by different countries all around the world – I know of some built by countries like Brazil, Argentina and Japan.




It stands for AMateur SATellite. **AMSAT** is a world-wide group of amateur radio operators (hams) who share an active interest in building, launching and then communicating with each other through non-commercial amateur radio satellites. The small satellites are known as Orbiting Satellites Carrying Amateur Radio, or OSCAR.
Sounds like fun! I have heard of amateur satellites, but never actually made a contact through one before.


Well, Mady, this your lucky day! Today, we're going to use my IC-910H that I have rigged up with a PS-125 power supply to this beam antenna-- right here in the parking lot. But for a more permanent set up, you should use set up your 910H base station with a mounted directional or omnidirectional antenna* in your ham shack.


I can see a satellite on this screen and it looks like it should be passing over us soon from the northeast! Is this the one you were talking about?


Yup, that satellite's pass will start in a couple of minutes. The software gives us the satellite latitude, longitude, azimuth and max elevation, as well as the pass duration.
To many big words! It hurts!

*An omnidirectional antenna is an antenna that radiates power uniformly in all directions. http://en.wikipedia.org/wiki/Antenna_%28electronics%29.

It's actually easier then it sounds. Latitude tells us the position north to south and Longitude is east to west. Azimuth** and altitude are used together to give the direction of an object in the sky in relationship to where you are. And by following the information on the screen we can tell just about when it will pass overhead and how long the pass duration will be.

I'm at Azimuth 199.0, Elevation -56.9 and Range 11,635.0km.

Where are you?

5/19/00 17:12:49 UTC Weather Sats configuration

18 Sats	NOAA 9	NOAA 10	METEOR 2-16	METEOR 2-17	METEOR 3-2
Azimuth	199.0°	278.5°	316.1°	88.1°	177.9°
Elevation	-56.9°	-57.4°	-35.4°	-54.5°	-47.7°
Range	11,635.0 km	11,676.5 km	8,891.3 km	11,490.9 km	10,921.9 km
Height	837.4 km	801.8 km	952.6 km	936.4 km	1,184.9
AOS time	18:14:03 UTC	18:13:19 UTC	17:32:29 UTC	21:58:20 UTC	18:23:0
LOS time	18:24:12 UTC	18:19:16 UTC	17:41:27 UTC	22:13:00 UTC	18:36:3
Until	01:01:13	01:00:29	00:19:39	04:45:30	01
Duration	00:10:09	00:05:57	00:08:57	00:14:39	00
AOS Az.	353°	66°	16°	4°	
Max El.	7°	2°	4°	17°	
LOS Az.	270°	19°	81°	122°	
Visual	Sun	Sun	Sun	Sun	
Orbit #	79,607	71,065	64,434	62,178	

VHF UPLINK

Cowabunga! Goin' up in VHF!

Yippee! I'm comin' back in UHF!

UHF DOWNLINK

With the 910H we'll use 2 meters for the uplink to talk to the satellite, and the satellite will then re-broadcast, or downlink, on 435 MHz for listening. It should be in range right about now.

Here Mady, give it a try!

Juneau, this is Mady, KD7QEZ in Kirkland, Washington.

Juneau, Alaska!

This is awesome

Wow

When will it be my turn?

**http://en.wikipedia.org/wiki/Azimuth

We'll track the satellite as it travels over our heads until it disappears in about 10 minutes over the horizon in the south west.

This is so cool! The satellite works just like our local 2 meter repeater on the hill, but is a lot higher and has way more range!
That is some serious DX work on only a Technician license.Thanks, Brien, this is just great for the kids!

YEAH!

We'll get a few more kids to take a turn here, we've got a few more minutes. When you come to Aerojet, you'll be seeing how we make and test the systems that make the satellites go and, you'll see how we use radio!

Thanks, Brien! This has really been inspirational.

A few days later at Aerojet...
Hi
AEROJET
Hi! I'm glad you all could come!
Hi Christa!
Hi!
Hi, I'm Christa's dad, Andy, KE7HRJ. The rest of the ham club is already here.
AEROJET
Welcome
Marcos Pontes
When I check in, do you need to also know my call sign? I'm Melanie, KE7HRA...
Hi! And I'm Rachel, KE7HQQ ...
and I'm Safa, KE7HQX.
And I'm Mia, KE7HQO!
Girls, I don't need your call signs. But write them on your name tags if you like.

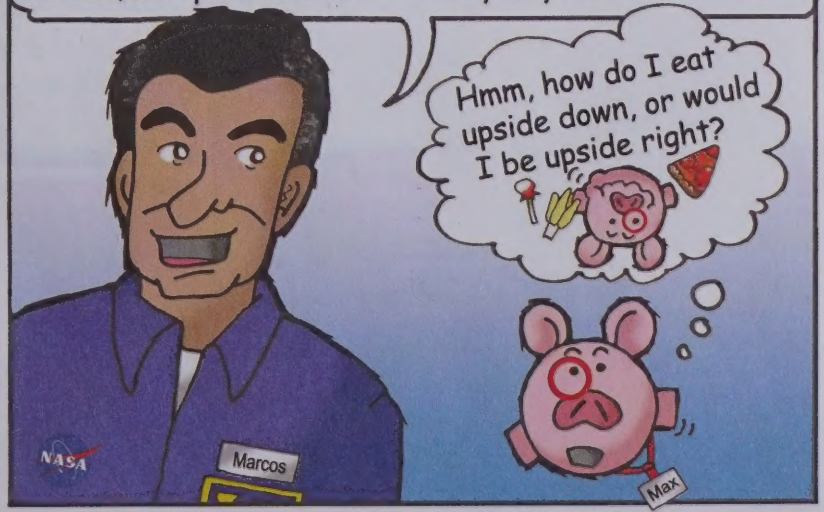
I just learned that today, by coincidence we have a real astronaut here visiting our Space Shuttle engine team.
Meet Lieutenant Colonel Marcos Pontes, PY0AEB, the first Brazilian astronaut, who was part of the 13th International Space Station Crew. He's here today with others to talk about how we can take satellites into space.

Glad to meet all of you fellow hams!

So, how long have you been an astronaut?

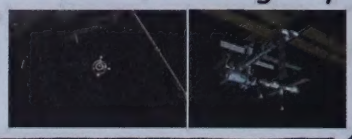
Well, first, I was a military jet pilot and then became a test pilot for many years. I joined NASA and I trained for a long time before I could fly on any missions. Now, I train other astronauts.

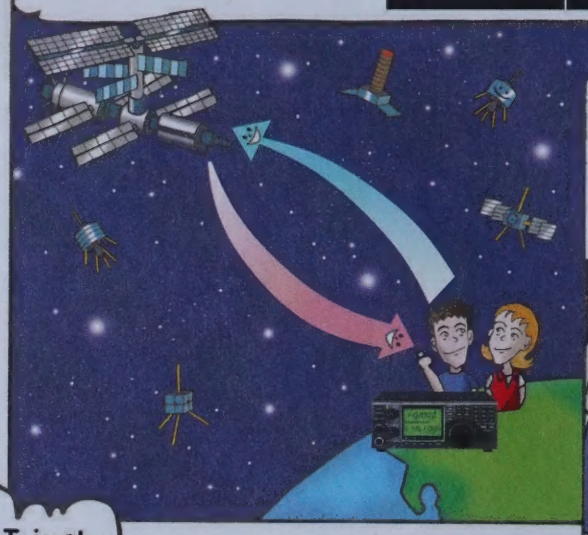
Many of us have dreamed about becoming astronauts as kids. It is a hard, but very satisfying career. All astronauts actually train as long as 10 years before their first space flight assignment. It takes a long time to learn all the details of their jobs in space, including systems, complex operations, and even how to eat, sleep and do other every day life activities.



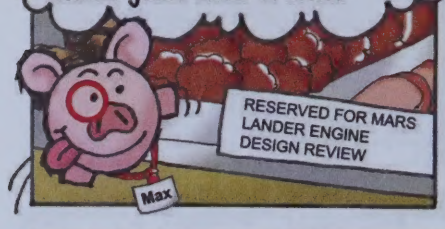
It is great that you are hams! Radio communications are a really big part of space travel.

One time we had to rely on ham operators for backup communication for the Space Station. There was a docking problem with the re-supply spacecraft and we were in danger of losing our normal relay satellite connection. So, we activated the Space Station Ham Contingency Network for the first time. Those guys did an awesome job!***





They must mean me! I just landed here, they won't miss just one treat!"



Study hard, keep talkin' on the radio, and enjoy your tour!

***http://www.arrl.org/news/stories/2006/10/31/100/

MAAAAAXXXXX!!
I'm back!
Max
MAAAAXXX!
I wonder if there are treats in the bottom of Zack's bag...
Let's get going on the tour. First stop, the manufacturing building.
Andy
Sara
Mady
Christa
Clair
Rachel
Mia
Where do you think he went? I didn't lose him! It looks like he ate some of the food off this table, maybe he went on ahead!
I hope you're right! The last thing we need is for Max to get into trouble. Look, grab your backpack and stay with the group... We'll keep an eye out for him.
Zack
.....
I'm getting pretty sleepy from all that food.

Machine Shop
Max...
Zzzz...

"Machine Shop"
This is the machine shop, where all the parts are made. A lot of what we make is very small, almost miniature!
Lab coat
Shoes
Pencil
Desk
Chair
trash

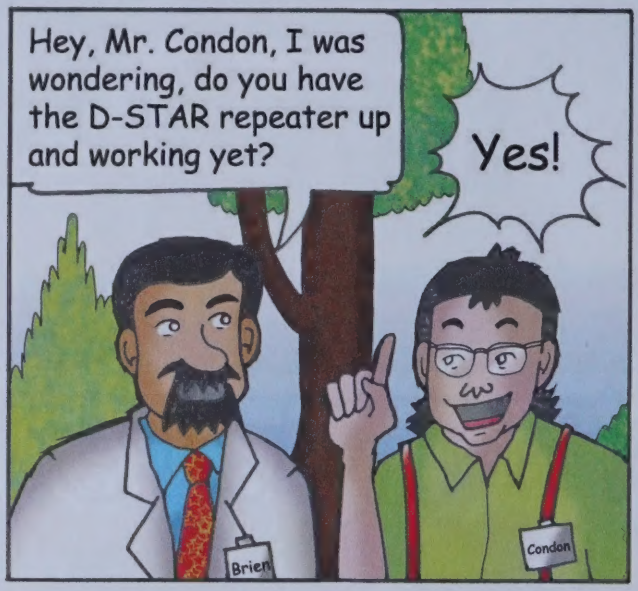
"Kitchen"
Kids, this is where we clean all the parts before we assemble them. We call this place the "kitchen". You'll find lots of large sinks in here, but no pots and pans.
HA
HA
HA
Mmmm, the kitchen... I think I need a snack!
Meat

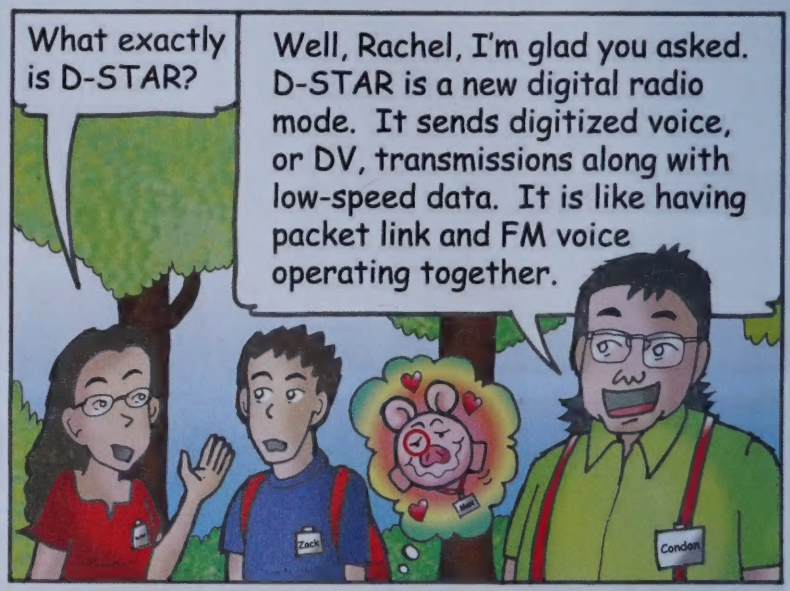
"Assembly"
Here you can see some of the propulsion systems for the satellites. These propulsion systems go on the Global Positioning System, or GPS, satellites.
COOL!
Zzz...
I have heard of GPS. You can use special electronics that figure out your exact location anywhere on earth by receiving radio signals from the satellites.
You are here.
GPS
You can see what the astronauts meant – radio is an incredibly important part of ALL spacecraft!
Andy, how do you know a satellite's position? How do you figure something like that out? I mean, you help make it go up into space, and move around and stuff, but how do you keep from losing the satellite?
Where are you?
Zack! That wasn't subtle; they'll think you lost Max!
Zack
Mady
Good question, Zack! We use radio signals! A radio signal from earth with a time code on it is sent up to the spacecraft. The spacecraft then "bounces" the signal back to earth. The amount of time it takes for a radio signal to get from earth to a satellite and back lets us figure out how far away it is. I think there's a poster in the measurement room that shows this....
Measurement Room
WOW!
And

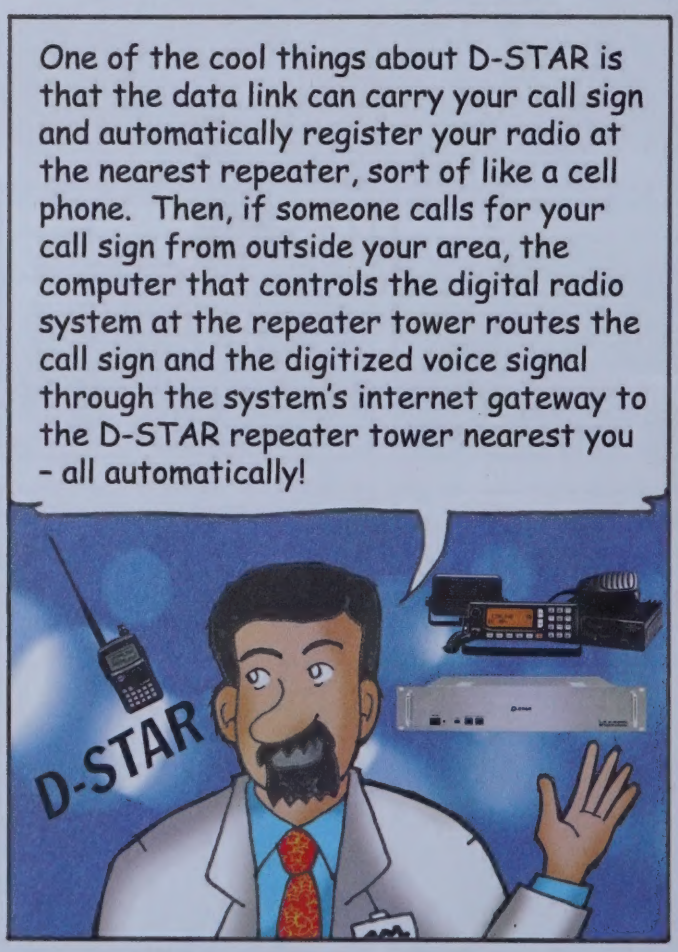
"Measurement"
Hi there, Andy!
Hi, fellow hams! This is where we measure things!
You are right, Andy. To be able to build anything, you have to measure everything! And radio signals help us every day! It's just one of our tools.
Hi!
WOW!
Mmm
Have you ever lost anything... in space?
Christa
Zack
Mady
Well, no, not exactly... you see we know that all radio waves travel at the speed of light, and knowing that can help us figure out the distances.
We should learn more about this to help us keep track of Max!
I think you should try being more organized first!
Zack
Mady
Let's move on to one of our many clean rooms. You'll have to look through the windows to see what's going on so we can keep everything clean as can be!
?
Zack
Mady
Andy

"Clean Room"
The clean room where some of the final assembly occurs. Today, they are finishing some welds on engines that will be used to land the next spacecraft on Mars.
Hello, my pretty, what are you doing in here?
Max
Wow, Mars!
Plunk!
Plunk!
?
Plunk!
Zack
Did you hear anything strange?
Max
Zack
No, you're imagining things. Let's stay with the group! They're going to another building where we're going to see them test for vibration.
Mady
Let's go!
?

Hi everyone! Glad you could make it! I'm on my way to the vibration lab. Andy, mind if I tag along?
Vibration Lab
Clean Room


Hey, Mr. Condon, I was wondering, do you have the D-STAR repeater up and working yet?
Yes!
Brien
Condon


What exactly is D-STAR?
Well, Rachel, I'm glad you asked. D-STAR is a new digital radio mode. It sends digitized voice, or DV, transmissions along with low-speed data. It is like having packet link and FM voice operating together.
Zack
Condon


One of the cool things about D-STAR is that the data link can carry your call sign and automatically register your radio at the nearest repeater, sort of like a cell phone. Then, if someone calls for your call sign from outside your area, the computer that controls the digital radio system at the repeater tower routes the call sign and the digitized voice signal through the system's internet gateway to the D-STAR repeater tower nearest you - all automatically!
D-STAR

You can even hook up a GPS sensor to your radio so your position can be sent on the data link along with your voice. Then people can track your exact location.
GPS port
V-82
Wow! D-STAR sounds out of this world! Mady...are you thinking what I'm thinking?
Andy
Zack
Mady
Really, Zack, calm down, We'll find Max... are you SURE you checked everywhere?

"Vibration Lab"
This is the vibration lab where we test rocket engines that will go up in space. The table shakes the engines to simulate a launch. They are getting ready for a vibration test on this development engine later today I think.
CAUTION
DO NOT enter when light is RED
That sounds really neat! But the entire room is like padded! Is that so it's soundproof?
That's right Mady! Even though the large table is being shaken, the whole room will feel the vibrations and it can get very loud in here!
Let's go to the test lab now where we fire the engines.
COOL!
?
Andy
Mady
!
On
Mmmm...
Zzzz...

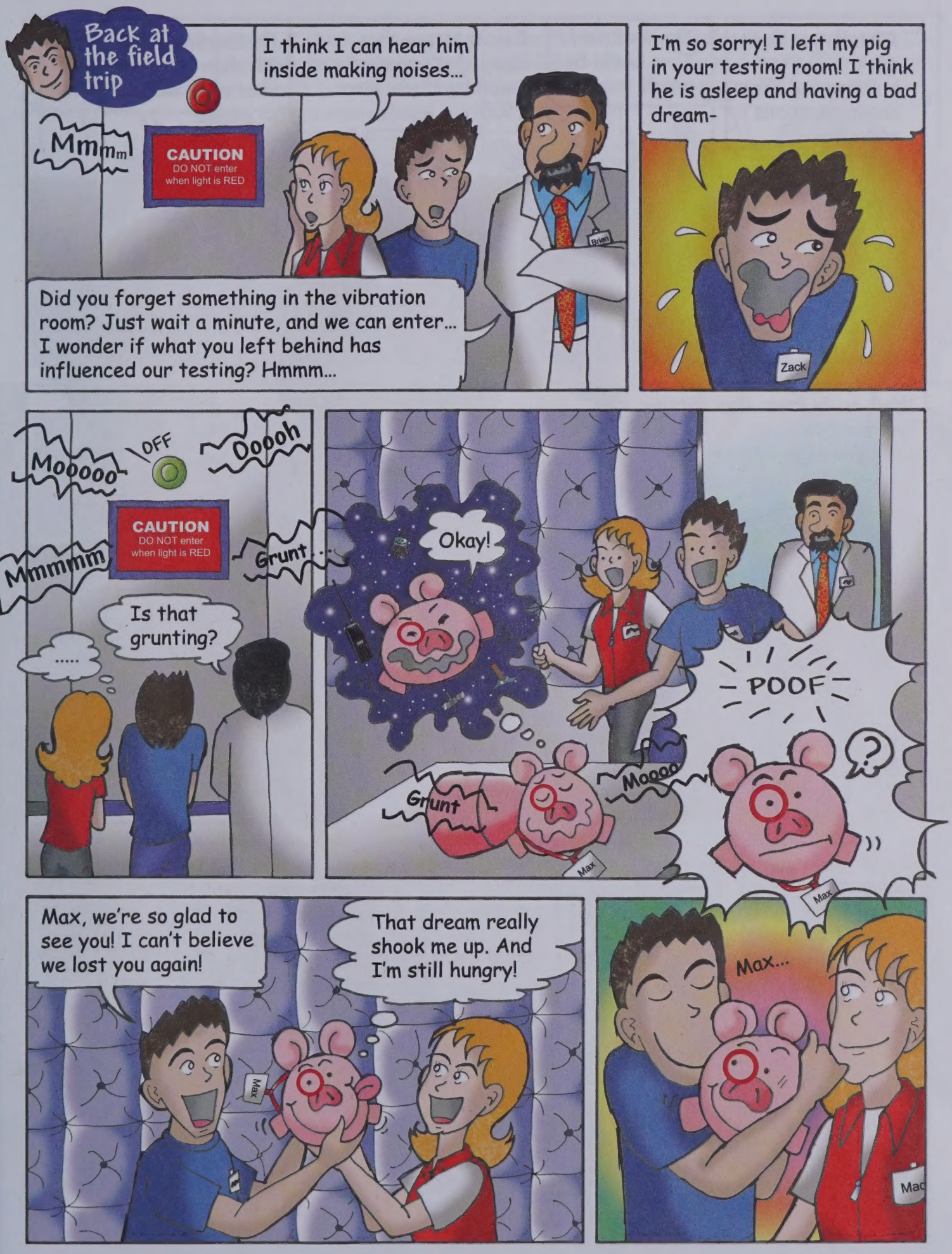
Zzz
Max's dream
Whoa!
I'm an astronaut! AND I have a jet pack for space walks! Cool!
I'm floating....
This is fun! Wow! There are a lot of interesting looking things up here! I wonder if any are amateur satellites!
"Hi!" Wait a minute, there seems to be something down there on the moon! I better take a closer look.
Hi
Hi
Curious! Are they carrying radios? I'll try and talk with them...let me see---
I forgot my radio!
How will I talk with them?

Back at the field trip
Oh no, I know I forgot something, but I don't know what.
Zack
What? You forgot something!?
Mady
I'm such a klutz. I lose everything.
Zack
You need to be more organized. You should first make a list of everything you brought and check it off. ...
Mady
Right,
a list...
OK
Also, have your room sterilized. It smells.... Also,....
Mady
Be QUIET!!!
Zack
OK, OK I'm only teasing, now let's retrace our steps...
Hang on, I'm trying to think, and you need to learn to criticize less.
No, I don't. You need anger management classes.
What's up, guys? Are we missing Max?! We need to concentrate on figuring out where he is.

Zzz
Max's dream
Hi! I'm from earth! Can you hear me?
Yes of course. You didn't need a radio, we're right here.
I miss my friends, and want to go home. Can you use your radio to help me get back?
Of course we can....
Hey, this looks like a D-STAR radio! It will automatically link me to the repeater nearest to Mady and Zack!
It would if you were on earth! Silly earth piggy! You will have to go to the Space Station, and try from there! These radios work with our repeater here! They're great for keeping everyone in touch!
You should try not to get lost and stay in touch with friends.
Bye!
Thanks, I'm off! Why oh why did I forget my radio!
Help! I need to use your radio to get me in touch with my friends on earth!
Yes, of course! Come on in and we'll set you up!

I hope this works! Maybe they're near the communications room where the IC-910H will pick up my signal.
We'll be passing by Mady and Zack very soon now.
Mady and Zack
WOW!
This is Max, KE7PIG, calling KD7QEZ for Mady and Zack in Kirkland, Washington.
"Communication Lab"
This is KD7QEZ. Max, is that you? How are you?
Yes it's me, and I am OK! I want to come home!
What are you doing? We are all worried about you! We can't find you! Zack is very upset!
Oh, I'm just in space traveling in a rocket ship around the earth.
Well you'll just have to stay there until we can send someone up there to relieve you. I have got to go now...
What! Wait!
How do I get down? I want to come home! I'll starve up here!

Back at the field trip
Zack, when do you last remember having your backpack with Max in it?
Well, he wasn't really in my bag... you know Max. We were talking and then he just seemed to disappear! We were looking at all kinds of things in the manufacturing building and then we met up with Brien, and then we were walking along and talking about D-STAR....
Zack
!
The vibration lab!
We'll be right back!
Max's dream
How did you get up there in the first place?
Well I went to sleep..... I got it!
You got what?
I can wake myself up! I am asleep right now and I just need to wake myself up then I will be home!
Great thinking, Max! I'm very proud of you. We'll see you after you wake up! Just think you want to wake up and you will! This is KD7QEZ signing off.
Okay!
Okay!


Back at the field trip
I think I can hear him inside making noises...
Mmmm
CAUTION
DO NOT enter when light is RED
Brian
Did you forget something in the vibration room? Just wait a minute, and we can enter... I wonder if what you left behind has influenced our testing? Hmmm...
I'm so sorry! I left my pig in your testing room! I think he is asleep and having a bad dream-
Zack
Mooooo
OFF
Ooooh
CAUTION
DO NOT enter when light is RED
Mmmmm
Grunt
Is that grunting?
.....
Okay!
POOF
Grunt
Moooo
Max
Max, we're so glad to see you! I can't believe we lost you again!
That dream really shook me up. And I'm still hungry!
Max
Max...
Mac

I'll take you both back to the main building and the communications room now.
Brien
Thanks Brien! That would be great!
I want to see the equipment you use here! I wonder if you have a 910H...
Of course we do! Come on, I'll show you... All's well that ends well.
Vibration Lab
Communication Lab
Well, aside from Max getting lost for a little while, I sure hope you enjoyed your tour.
We did! THANKS!
Max
Mady
Rachel
Chris
Sara
Karen
I'll be glad to get home. When is your mom picking us up?
My mom?? I thought your dad was picking us up!
Max
Mady
Oh no! We better call someone. This could take a while.
Let's use my new D-STAR handheld radio. It will be faster! Besides, cell coverage out here is probably not so good!
Good Point!
Max
Max
Mady

I can't wait until we get our drivers' licenses!
Yeah, I think we can start studying next year. Then we won't have to wait to be driven everywhere.
Max

The first thing I am going to do is put a new IC-2820H D-STAR mobile radio with GPS in my car, so I can track all the places I'm gonna go!
Zack
Max
That's a great idea, Zack! I'll do it too!

Radios pictured from top to bottom, left to right are handhelds, IC-T91A, IC-V82, IC-91AD and mobiles, ID-1, IC-2820H, ID-800H, IC-7000 and the IC-2200H.

To download a full version of the U.S.A. Amateur Radio HF Band Plan, complete with country codes visit:
http://www.icomamerica.com/downloads/default.asp

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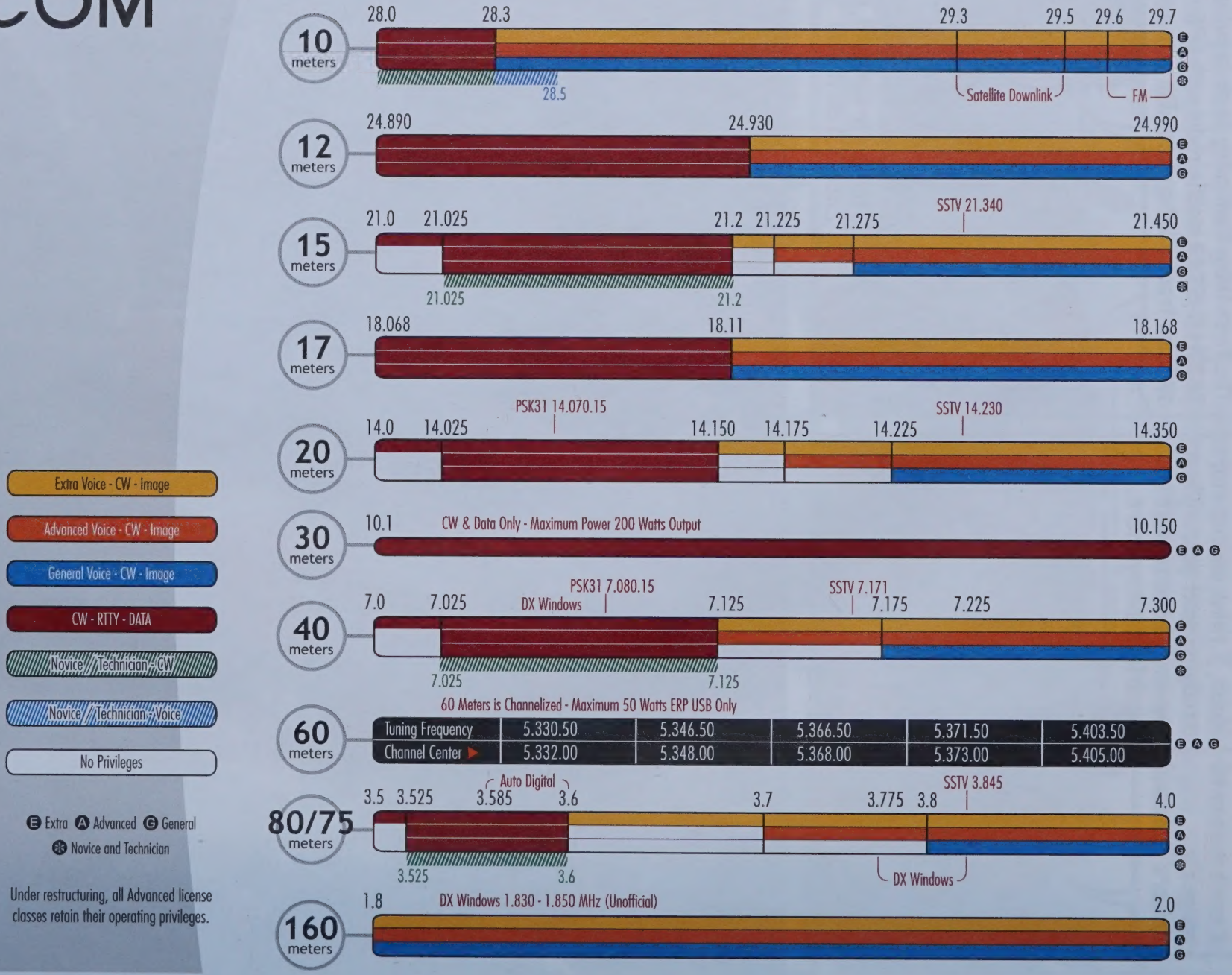
U.S.A. Amateur Radio HF Band Plan



Under restructuring, all Advanced license classes retain their operating privileges.

SPACE CAMP®

Young hams interested in the U.S. Space Program should check out Space Camp. Located in Huntsville, Alabama, Space Camp uses space to excite and educate children between the ages of 9-18 in the fields of math, science and technology. Teamwork, self-confidence and communication will be achieved through state-of-the-art simulations, missions, rocket building and robotics.

The camp covers everything you need to know about Space Shuttle Systems and life aboard the Orbiter and Space Station. Try out space food, learn to sleep in space and even how to go to the bathroom in space!

Train on the Multi-Axis trainer that spins you all around. Take a turn on the 5-Degrees of Freedom Chair (it's like a chair floating on air). Be like Apollo astronauts preparing for their trip to the moon by taking a walk in the 1/6th Gravity Chair! And strap on a jet pack — an MMU, that's NASA talk for a Manned Maneuvering Unit. Space Campers also train in rocket construction to build and launch their own one-stage model rockets.

Space Academy®, for kids 12-14, is an increased intensity program of astronaut and mission training and academics. Simulated missions to a space station and crew rotation highlight the week.

The Advanced Space Academy® program is for young adults between the ages of 15-18 and offers a college-accredited program through the University of Alabama-Huntsville (UAH). All Advanced Space Academy participants will earn one hour of Freshman-level general science credit from UAH.

Parent/Child Space Camp®, for kids ages 7-12, is also available.

For more information, check out the Space Camp website today!

http://www.spacecamp.com

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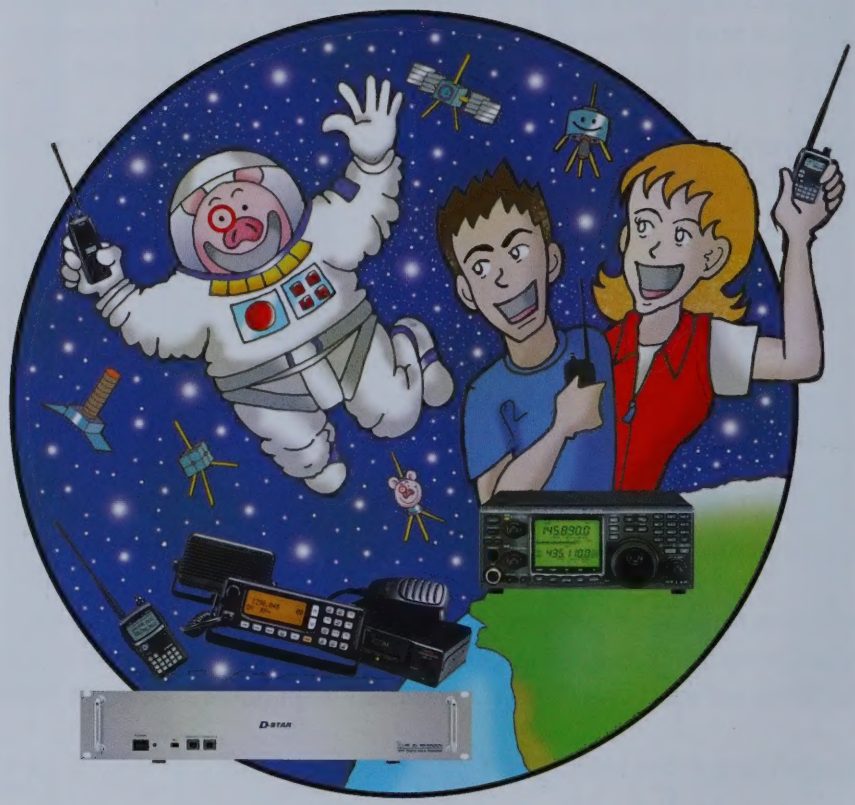

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